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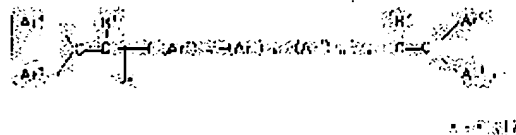
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(54) ORGANIC COMPOUND AND ORGANIC ELECTROLUMINESCENCE ELEMENT USING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a new organic compound which can exhibit a high luminous efficiency, when used as a constituent for organic electroluminescence elements (organic EL elements), and to provide an organic EL element using the same compound.

SOLUTION: An organic compound of the general formula (I) (the symbols are as described in the specification). An organic EL element has an organic luminescence layer nipped between a pair of electrodes, and the organic luminescence layer contains the organic compound of general formula (I).



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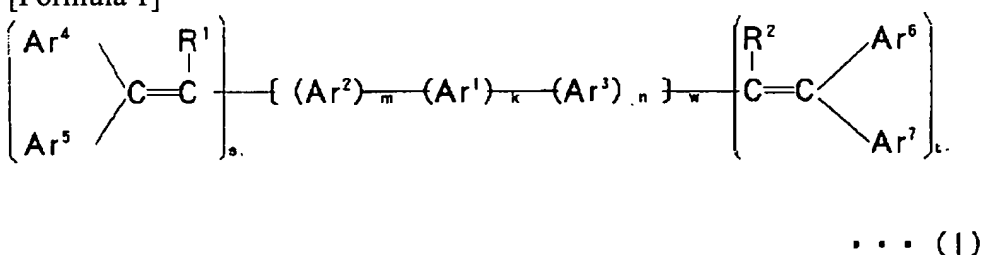
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CLAIMS

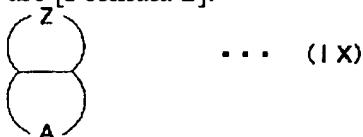
[Claim(s)]

[Claim 1] The organic compound expressed with a general formula (I).

[Formula 1]



The inside of [type and Ar1 are organic radicals of bivalence which consist of two cyclic structures which are expressed with a general formula (IX), and which share two carbon atoms of each other, and are [Formula 2].

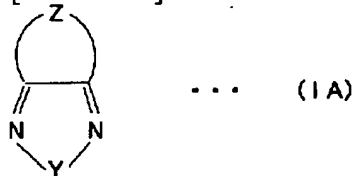


(IX) Inner Z is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings. A shows the organic radical which forms complex 5 membered-ring of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, and Z or A has two joint hands for combining with other configuration units in a compound. Ar2 and Ar3 are the arylene radical of the carbon numbers 6-30 which may have the substituent independently, respectively, or O, N, S and Si. The heterocycle type machine of the bivalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from inside, However, the aromatic series radical (aryl group) of the monovalence to which Ar2 and Ar3 (it is Ar2 and Ar3 by the side of the end of a molecule when n is m and 2) correspond when t is s and 0 or the heterocycle type machine of monovalence, When t is s and 2, Ar2 and Ar3 (when n is m and 2, it is Ar2 and Ar3 by the side of the end of a molecule) show a trivalent corresponding aromatic series radical or a trivalent corresponding heterocycle type machine. Ar4-Ar7 may show the heterocycle type machine of the monovalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from the aryl group of the carbon numbers 6-20 which may have the substituent independently, respectively, or O, N, S and Si, and Ar4-may differ from Ar7 mutually. R1 and R2 Independently, respectively A hydrogen atom, the alkyl group of carbon numbers 1-6, The aryl group of the carbon numbers 6-20 which may have the substituent, the alkoxy group of carbon numbers 1-6, The amino group permuted by the aryloxy group of the carbon numbers 5-18 which may have the substituent, the aralkyloxy radical of carbon numbers 7-18, and the aryl group of the carbon numbers 5-16 which may have the substituent, A

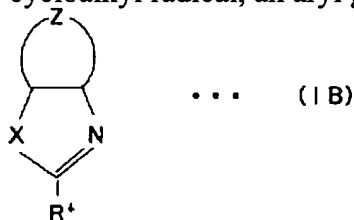
nitro group, a cyano group, the ester group of carbon numbers 1-6, or a halogen atom is shown, and it is R1. R2 You may differ mutually. t shows m, n, s and 0, 1 or 2, k and w1, or 2. However, it is $m+s \neq 0$ and $n+t \neq 0$.]

[Claim 2] The organic compound according to claim 1 which is the organic radical which consists of two cyclic structures as which Ar1 in a general formula (I) is expressed in following either of general formula (IA)- (ID), and which share two carbon atoms of each other.

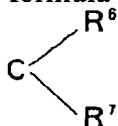
[Formula 3]



Z is a divalent radical among [type (IA), it is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share [each other], or partial saturation, or six membered-rings, and Y shows O, S, or N-R3. However, R3 A hydrogen atom, the alkyl group in which all may have the substituent, a cycloalkyl radical, an aryl group, or a heterocycle type machine is expressed.] [Formula 4]

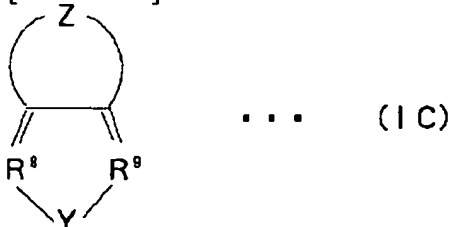


Z and R4 of Z of a general formula (IA) are the same as that of R3 of a general formula (IA) among [type (IB), and X is O, S, N-R5, or (the inside of a formula and R5 are the same as R3 of a general formula (IA)) [Formula 5].

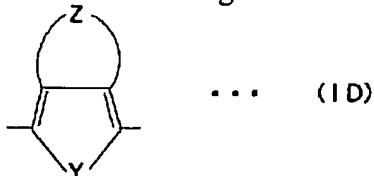


(The inside of a formula, R7, and R8 are the same as R3 of general formula (IA)) is shown.]

[Formula 6]



Z and Y are the same as Z and Y of a general formula (IA) among [type (IC), and R8 and R9 are the same as R3 of a general formula (IA).] [Formula 7]



Z is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five

membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings among [type (ID)], and Y is the same as Y of a general formula (IA).]

[Claim 3] The organic electroluminescent element which is an organic electroluminescent element which has at least the organic luminous layer pinched by inter-electrode [of a pair], and is characterized by containing an organic compound according to claim 1 or 2.

[Claim 4] The organic electroluminescent element according to claim 3 which makes an emission band region mainly come to contain an organic compound according to claim 1 or 2.

[Claim 5] The organic electroluminescent element according to claim 4 which makes an organic luminous layer come to contain an organic compound according to claim 1 or 2.

[Claim 6] The organic electroluminescent element according to claim 3 or 5 which makes an organic luminous layer come to contain a recombination site morphogenetic substance further.

[Claim 7] The organic electroluminescent element according to claim 6 whose recombination site morphogenetic substance is a fluorescent material of fluorescence quantum yields 0.3-1.0.

[Claim 8] The organic electroluminescent element according to claim 6 or 7 as which the recombination site morphogenetic substance was chosen from a styryl amine system compound, the Quinacridone derivative, the rubrene derivative, the coumarin derivative, and the pyran derivative and which is a kind at least.

[Claim 9] The organic electroluminescent element according to claim 3 which contains an organic compound according to claim 1 or 2 as a recombination site morphogenetic substance.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the organic electroluminescent element (electroluminescence is hereafter written as "EL".) using a new organic compound and new it. This invention relates to an organic compound useful as a component of an organic EL device, and the organic EL device which has the outstanding luminous efficiency which comes to use this thing in more detail.

[0002]

[Description of the Prior Art] Since the organic EL device using electroluminescence is self-luminescence, its visibility is high, and since it is a perfect solid-state component, it has the description of excelling in shock resistance. Therefore, it is used for fields, such as a back light of a thin film display component or a liquid crystal display, and the flat-surface light source. Although current and the electroluminescent element put in practical use are distributed EL elements, since this distributed EL element needs the alternating voltage of dozens of volts and 10kHz or more, that drive circuit is complicated. Since it is such, the organic EL device which driver voltage can be reduced to about 10 volts, and can emit light in high brightness is studied briskly in recent years. For example, as an organic thin film EL element, the thing of the laminating mold structure of a transparent electrode / hole injection layer / luminous layer / back plate is proposed (Appl.Phys.Lett., the 51st volume, the 913-915th page (1987), and JP,63-264629,A), and these are made as [pour / an electron hole / efficiently / into a luminous layer] by the hole injection layer used here. Although the luminous layer used in such an organic EL device could be a monolayer, since the balance of electronic transportability and electron hole transportability was not good, by the monolayer, improvement in the engine performance was achieved by carrying out a laminating to a multilayer.

[0003] By the way, in order to form in a laminated structure in this way, the production process becomes complicated, a duration also becomes long, and also there is a problem that there are many limits of filminess being required of each class. Furthermore, in recent years, miniaturization of information machines and equipment etc. and the request of the shift to a pocket mold increase, and the request of the further low-battery-izing of such driver voltages is increasing. Then, development of luminescent material, an electron hole transportation ingredient, etc. is tried for such lightweight-izing or low-battery-izing of driver voltage. Although the anthracene is known as a luminescent material, to introduce various substituents is tried from formation of a uniform thin film being difficult. For example, using a condensed multi-ring aromatic hydrocarbon compound and a complex 5 membered-ring compound is proposed as a luminescent material of an organic EL device (JP,4-178488,A, a 6-228544 official report, a 6-228545 official report, a 6-228546 official report, a 6-228547 official report, a 6-228548 official report, a 6-228549 official report, a 8-311442 official report, a 8-12969 official report, and 10-152677 official report). However, each thing using these compounds has the problem that luminous efficiency and a luminescence life are not enough.

[0004]

[Problem(s) to be Solved by the Invention] Under such a situation, this invention aims at demonstrating high luminous efficiency and offering a long lasting new compound and the organic EL device using this, when it uses as a component of an organic EL device.

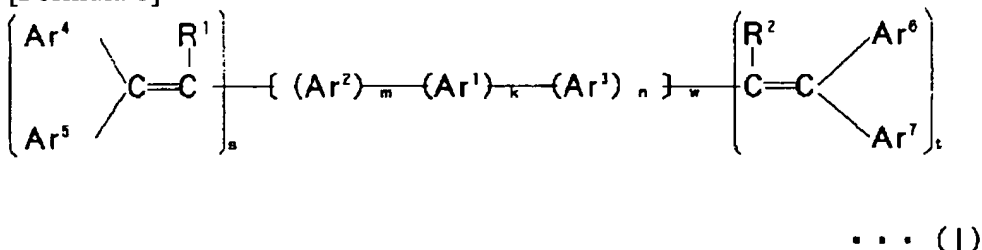
[0005]

[Means for Solving the Problem] this invention persons complete this invention for the ability of the purpose to be attained with the organic compound which has specific structure based on a header and this knowledge, as a result of repeating research wholeheartedly, in order to attain said purpose. That is, the outline of this invention is as follows.

[1] The organic compound expressed with a general formula (I).

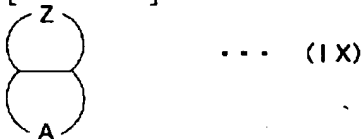
[0006]

[Formula 8]



[0007] The inside of [type and Ar1 are organic radicals of bivalence which consist of two cyclic structures which are expressed with a general formula (IX), and which share two carbon atoms of each other, and are [0008].

[Formula 9]



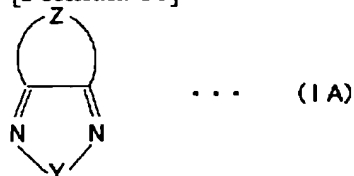
[0009] (IX) Inner Z is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings. A shows the organic radical which forms complex 5 membered-ring of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, and Z or A has two joint hands for combining with other configuration units in a compound. Ar2 and Ar3 are the arylene radical of the carbon numbers 6-30 which may have the substituent independently, respectively, or O, N, S and Si. The heterocycle type machine of the bivalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from inside, However, the aromatic series radical (aryl group) of the monovalence to which Ar2 and Ar3 (it is Ar2 and Ar3 by the side of the end of a molecule when n is m and 2) correspond when t is s and 0 or the heterocycle type machine of monovalence, When t is s and 2, Ar2 and Ar3 (when n is m and 2, it is Ar2 and Ar3 by the side of the end of a molecule) show a trivalent corresponding aromatic series radical or a trivalent corresponding heterocycle type machine.

[0010] Ar4-Ar7 may show the heterocycle type machine of the monovalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from the aryl group of the carbon numbers 6-20 which may have the substituent independently, respectively, or O, N, S and Si, and Ar4-may differ from Ar7 mutually. R1 and R2 Independently, respectively A hydrogen atom, the alkyl group of carbon numbers 1-6, The aryl group of the carbon numbers 6-20 which may have the substituent, the alkoxy group of carbon numbers 1-6, The amino group permuted by the aryloxy group of the carbon numbers 5-18 which may have the substituent, the aralkyloxy radical of carbon numbers 7-18, and the aryl group of the carbon numbers 5-16 which may have the substituent, A nitro group, a cyano group, the ester group of carbon numbers 1-6, or a halogen atom is shown, and it is R1. R2 You may differ mutually. t shows m, n, s and 0, 1 or 2, k and w, 1, or 2. However, it is $m+s \neq 0$ and $n+t \neq 0$.]

[2] An organic compound given in the above [1] which consists of two cyclic structures as which Ar1 in a general formula (I) is expressed in following either of general formula (IA)- (ID), and which share two carbon atoms of each other.

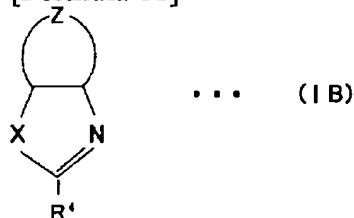
[0011]

[Formula 10]



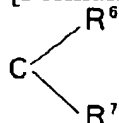
[0012] Z is a divalent radical among [type (IA)], it is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share [each other], or partial saturation, or six membered-rings, and Y shows O, S, or N-R3. However, R3 A hydrogen atom, the alkyl group in which all may have the substituent, a cycloalkyl radical, an aryl group, or a heterocycle type machine is expressed.] [0013]

[Formula 11]



[0014] Z and R4 of Z of a general formula (IA) are the same as that of R3 of a general formula (IA) among [type (IB)], and X is O, S, N-R5, or (the inside of a formula and R5 are the same as R3 of a general formula (IA)) [0015].

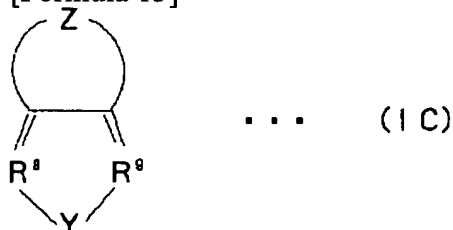
[Formula 12]



[0016] (The inside of a formula, R7, and R8 are the same as R3 of general formula (IA)) is shown.]

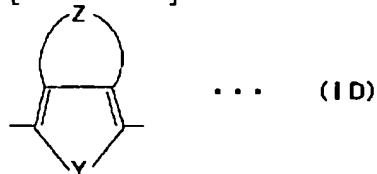
[0017]

[Formula 13]



[0018] Z and Y are the same as Z and Y of a general formula (IA) among [type (IC)], and R8 and R9 are the same as R3 of a general formula (IA).] [0019]

[Formula 14]



[0020] Z is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings among [type (ID)], and Y is the same as Y of a general formula (IA).]

[3] The organic electroluminescent element which is an organic electroluminescent element which has at least the organic luminous layer pinched by inter-electrode [of a pair], and is characterized by containing the above [1] or an organic compound given in [2].

[4] An organic electroluminescent element given in the above [3] which makes an emission band region mainly come to contain an organic compound according to claim 1 or 2.

[5] An organic electroluminescent element given in the above [4] which makes an organic luminous layer come to contain an organic compound the above [1] or given in [2].

[6] The above [3] which makes an organic luminous layer come to contain a recombination site morphogenetic substance further, or an organic electroluminescent element given in [5].

[7] An organic electroluminescent element given in the above [6] whose recombination site morphogenetic substance is a fluorescent material of fluorescence quantum yields 0.3-1.0.

[8] The above [6] from which the recombination site morphogenetic substance was chosen from a styryl amine system compound, the Quinacridone derivative, the rubrene derivative, the coumarin derivative, and the pyran derivative and which is a kind at least, or an organic electroluminescent element given in [7].

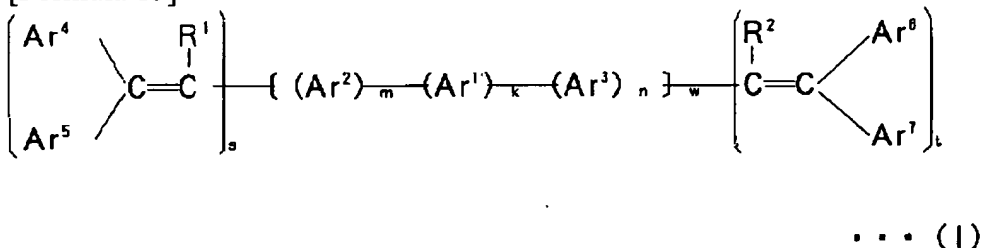
[9] The organic electroluminescent element according to claim 3 which contains an organic compound the above [1] or given in [2] as a recombination site morphogenetic substance.

[0021]

[Embodiment of the Invention] The organic compound of this invention is a general formula (I).

[0022]

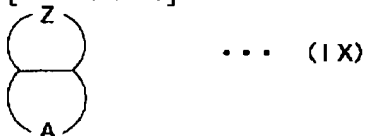
[Formula 15]



[0023] It is the compound which comes out and has the structure expressed. And in this general formula (I), Ar1 is an organic radical of bivalence which consists of two cyclic structures which are expressed with a general formula (IX), and which share two carbon atoms of each other.

[0024]

[Formula 16]



[0025] Z in this general formula (IX) is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings. although there is especially no limit as a hetero atom which may be contained in this hydrocarbon group Z -- usually -- O, S, N, P, and Si etc. -- each atom is mentioned. These hetero atoms may also be included in [one] Z, and may also be included two or more pieces. When two or more pieces are included, you may be a different atom even if it is the same atom. As a suitable example of the cyclic structure of five membered-rings of

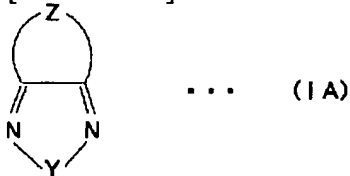
the saturation containing this Z, or partial saturation, or six membered-rings, complex 5 membered-ring of an aromatic series ring, saturation, or partial saturation or six membered-rings are mentioned. In addition, the polycyclic compound of 2-6 is also contained in an aromatic series ring here for a condensed multi-ring compound, for example, the condensed ring.

[0026] On the other hand, A of a general formula (IX) is a radical which forms complex 5 membered-ring of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, and is the same as that of the hetero atom which may be contained in said Z as a hetero atom which constitutes complex 5 membered-ring. In addition, since a general formula (IX) is the radical of bivalence, it has two joint hands for Above Z and A to combine with other configuration units in a compound.

[0027] Next, the still more desirable embodiment about Ar1 of a general formula (I) is explained. The organic radical of bivalence which consists of two cyclic structures which are expressed with either of general formula (IA)- (ID), and which share two carbon atoms of each other is used for Ar1 as the desirable embodiment. A general formula (IA) is expressed as follows.

[0028]

[Formula 17]



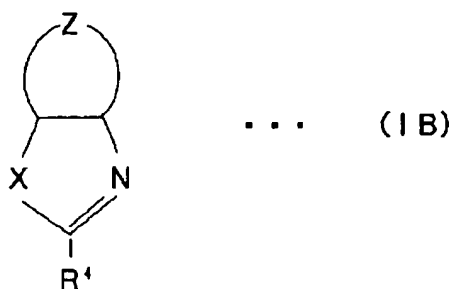
[0029] And Z in this general formula (IA) is a divalent radical, and is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share [each other], or partial saturation, or six membered-rings.

[0030] Moreover, Y is O, S, or N-R3. It is shown. However, R3 A hydrogen atom, the alkyl group in which all may have the substituent, a cycloalkyl radical, an aryl group, or a heterocycle type machine is expressed. As an example of the alkyl group which has the substituent and may be A methyl group, an ethyl group, various propyl groups, various butyls, various pentyl radicals, As a cycloalkyl radical which there are various hexyl groups, various heptyl radicals, various octyl radicals, various dodecyl, various stearyl radicals, a TORIKURORO methyl group, etc., and may have the substituent As an aryl group which there are a cyclopentane radical, a cyclohexane radical, a dimethylcyclohexane radical, etc., and may have the substituent A phenyl group, a biphenyl radical, a terphenyl radical, a naphthyl group, an anthryl radical, As a heterocycle type machine which there are a phenan tolyl group, a fluorenyl group, a pyrenyl radical, etc., and may have the substituent A pyrrole radical, a pyrroline radical, a pyrazole radical, a pyrazoline radical, an IMIDAZO-RU radical, A triazole radical, a pyridine radical, a pyridazine radical, a pyrimidine radical, a pyrazine radical, A triazine radical, the Indore radical, a pudding radical, a quinoline radical, an isoquinoline radical, a SHINORIN radical, a quinoxaline radical, a benzoquinoline radical, and full -- me -- non -- a radical -- A carbazol group, an oxazole radical, an OKISA diazo-RU radical, a thiazole radical, A thiadiazole radical, a triazole radical, an imidazole group, a benzooxazole radical, A benzothiazole radical, a benzotriazol radical, a benzimidazole radical, A bis-benzooxazole radical, a bis-benzothiazole radical, a bis-benzimidazole radical, Residue of the monovalence of a heterocyclic compound, such as an anthrone radical, a dibenzofuran radical, a dibenzo thiophene radical, an anthraquinone radical, an acridone radical, a phenothiazin radical, a pyrrolidine radical, a dioxane radical, and a morpholine radical, is mentioned.

[0031] The general formula (IB) which is Ar1 as a desirable embodiment is expressed with a degree type.

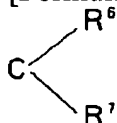
[0032]

[Formula 18]



[0033] The inside of this formula (IB) and Z are Z and R₄ of a general formula (IA). It is the same as R₃ of a general formula (IA), and X is O, S, and N-R₅. Or [0034]

[Formula 19]

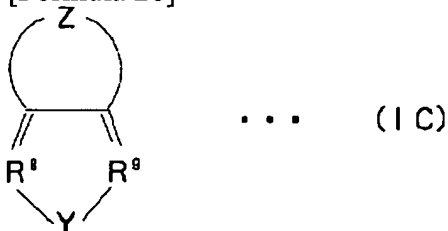


[0035] It comes out. Here, it is R₅, R₆, and R₇. It is all R₃ of a general formula (IA). It is the same.

[0036] Subsequently, the general formula (IC) which is the desirable embodiment of Ar₁ is as follows.

[0037]

[Formula 20]

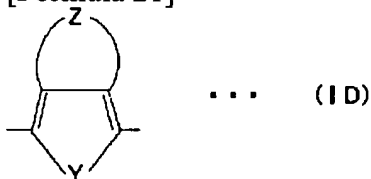


[0038] Z and Y of a general formula (IA) of Z are the same as that of Y of a general formula (IA) among this formula (IC), and it is R₈ and R₉. R₃ of a general formula (IA) It is the same.

[0039] Furthermore, the general formula (ID) which is the desirable embodiment of Ar₁ is as follows.

[0040]

[Formula 21]



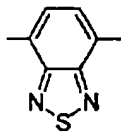
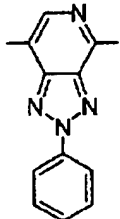
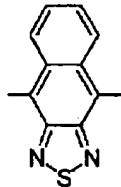
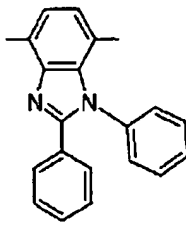
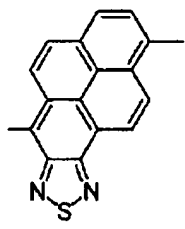
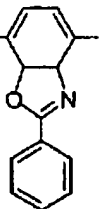
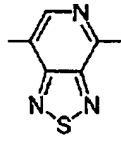
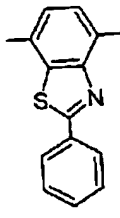
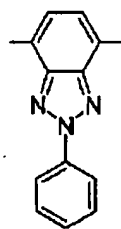
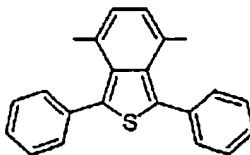
[0041] And Z is the hydrocarbon group which may contain the hetero atom which forms the cyclic structure of five membered-rings of the saturation which may have a substituent with two carbon atoms to share, or partial saturation, or six membered-rings among a general formula (ID), and Y is the same as Y of a general formula (IA).

[0042] In the case of a general formula (ID), Z does not have the joint hand combined with other configuration units in a compound, but complex 5 membered-ring is the mode which has two joint hands.

[0043] The following thing is mentioned as an example of representation of the above Ar₁.

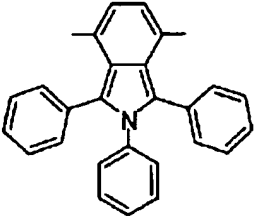
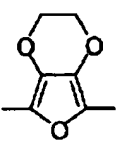
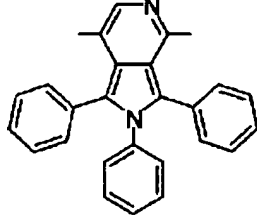
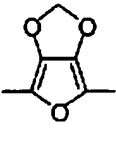
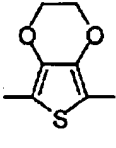
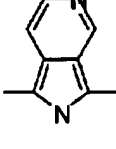
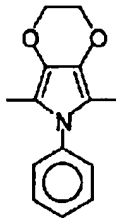
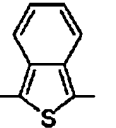
[0044]

[Formula 22]

(1)		(6)	
(2)		(7)	
(3)		(8)	
(4)		(9)	
(5)		(10)	

[0045]

[Formula 23]

(11)		(16)	
(12)		(17)	
(13)		(18)	
(14)			
(15)			

[0046] Next, Ar₂ and Ar₃ in a general formula (I) are explained. Ar₂ and Ar₃ in a general formula (I) show the heterocycle type machine of the bivalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from the arylene radical of the carbon numbers 6-30 which may have the substituent, respectively, or O, N, S and Si. As an arylene radical of carbon numbers 6-30, there are a phenylene group, a naphthylene radical, a biphenylene radical, an anthra NIREN radical, a terphenylene radical, etc. here, for example. On the other hand, as a heterocycle type machine of the bivalence of carbon numbers 4-30 For example, a furan, a thiophene, a pyrrole, a 2-hydroxy pyrrole, benzofuran, iso benzofuran, 1-benzothiophene, 2-benzothiophene, Indore, an iso indole, indolizine, a carbazole, a 2-hydroxy pyran, a 2-hydroxy chromene, 1-hydroxy-2-benzopyran, a xanthene, 4-hydroxy thiopyran, a pyridine, a quinoline, an isoquinoline, a 4-hydroxy kino lysine, and phenan -- a pickpocket -- gin, an acridine, oxazole, an isoxazole, a thiazole, an iso thiazole, and furazan -- An imidazole, a pyrazole, benzimidazole, a 1-hydroxy imidazole, 1, 8-NAFUCHI lysine, pyrazine, A pyrimidine, pyridazine, quinoxaline, quinazoline, SHINORIN, phthalazine, PYURIN, Teri Jin, peri MIJIN, 1, 10-phenan SURORIN, CHIAN Indanthrene, a FENOKI satin, phenoxazine, phenothiazin, phenazine, FENASAJIN, The residue of the bivalence of heterocyclic compounds, such as silacyclo pentadiene and SHIRABENZEN, is mentioned. When s of a general formula (I) and t are 0, however, these Ar₂ and Ar₃

(when n is m and 2, it is a thing by the side of the end of a molecule among Ar2 and Ar3) the corresponding aromatic series radical (aryl group) of monovalence -- or -- A heterocycle type machine is expressed, and when s and t are 2, these Ar2 and Ar3 (when n is m and 2, it is a thing by the side of the end of a molecule among Ar2 and Ar3) express a trivalent corresponding aromatic series radical machine or a trivalent corresponding heterocycle type machine. Even if these Ar2 and Ar3 are mutually the same, they may differ.

[0047] Then, Ar4-Ar7 in a general formula (I) are explained. Ar4-Ar7 in a general formula (I) show the heterocycle type machine of the monovalence of the carbon numbers 4-30 which contain at least a kind of hetero atom chosen from the aryl group of the carbon numbers 6-20 which may have the substituent independently, respectively, or O, N, S and Si. Here, as an example of the aryl group of carbon numbers 6-20, although a phenyl group, a naphthyl group, a biphenyl radical, an anthranil, a terphenyl radical, a phenanthrene radical, a pyrenyl radical, a diphenyl naphthyl group, a diphenyl anthranil, a styryl radical, a styryl phenyl group, etc. are mentioned, a phenyl group, a naphthyl group, a biphenyl radical, and an anthranil are desirable also in these. On the other hand, as an example of the heterocycle type machine of the monovalence of carbon numbers 4-30 A furan, a thiophene, a pyrrole, a 2-hydroxy pyrrole, benzofuran, iso benzofuran, 1-benzothiophene, 2-benzothiophene, Indole, an iso indole, indolizine, a carbazole, a 2-hydroxy pyran, a 2-hydroxy chromene, 1-hydroxy-2-benzopyran, a xanthene, 4-hydroxy thiopyran, a pyridine, a quinoline, an isoquinoline, a 4-hydroxy kina lysine, and phenanthrene -- a pickpocket - gin, an acridine, oxazole, an isoxazole, a thiazole, an iso thiazole, and furazan -- An imidazole, a pyrazole, benzimidazole, a 1-hydroxy imidazole, 1, 8-NAFUCHI lysine, pyrazine, a pyrimidine, pyridazine, KINAKI sarin quinazoline, SHINORIN, phthalazine, PYURIN, Teri Jin, peri MIJIN, 1, 10-phenanthrene SURORIN, The residue of the monovalence of heterocyclic compounds, such as CHIAN Indanthrene, a FENOKI satin, phenoxazine, phenothiazine, phenazine, FENASAJIN, silacyclo pentadiene, and SHIRABENZEN, is mentioned. These Ar4-Ar7 may be mutually the same, and they may differ.

[0048] Moreover, you may differ, even if m, n, and k in a general formula (I) are 1 or 2, respectively, and two Ar(s)1 are the same, when k is 2, when m is 2, even when two Ar(s)2 are the same, ***** is also good, and when n is 2, even if two Ar(s)3 are the same, they may differ. Moreover, w shows 1 or 2.

[0049] And these Ar1 -Ar7 As a substituent which you may have, they are the amino group permuted by the alkyl group of carbon numbers 1-6, the aryl group of carbon numbers 6-20, the alkoxy group of carbon numbers 1-6, the aryloxy group of carbon numbers 5-18, the aralkyloxy radical of carbon numbers 7-18, and the aryl group of carbon numbers 5-16, a nitro group, a cyano group, the ester group of carbon numbers 1-6, a halogen atom, etc.

[0050] Here, as an example of the alkyl group of carbon numbers 1-6, a methyl group, an ethyl group, a propyl group, an isopropyl group, butyl, an isobutyl radical, sec-butyl, tert-butyl, various pentyl radicals, various hexyl groups, etc. are mentioned, and a phenyl group, a biphenyl radical, an anthranil, a terphenyl radical, a phenanthrene radical, a pyrenyl radical, a diphenyl anthranil, a styryl radical, a styryl phenyl group, etc. are mentioned as an aryl group of carbon numbers 6-20.

[0051] As an example of the alkoxy group of carbon numbers 1-6, a methoxy group, an ethoxy radical, a propoxy group, an isopropoxy group, a butoxy radical, an iso butoxy radical, a sec-butoxy radical, a tert-butoxy radical, various pentyloxy radicals, various hexyloxy radicals, etc. are mentioned.

[0052] As an example of the aryloxy group of carbon numbers 5-18 A phenoxy group, a tolyloxy radical, a naphthyloxy radical, etc. as an example of the aralkyloxy radical of carbon numbers 7-18 A benzyloxy radical, a phenethyloxy radical, a naphthyl methoxy group, etc. as an example of the amino group permuted by the aryl group of carbon numbers 5-16 A diphenylamino radical, a dinaphthylamino radical, a naphthyl phenylamino radical, a ditolylamino radical, etc. as an example of the ester group of carbon numbers 1-6 A methoxycarbonyl group, an ethoxycarbonyl radical, a propoxy carbonyl group, an isopropoxycarbonyl radical, etc. are mentioned for a fluorine atom, a chlorine atom, a bromine atom, etc. as an example of a halogen atom.

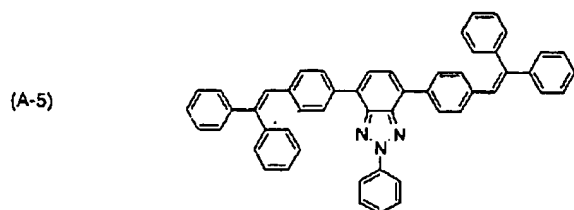
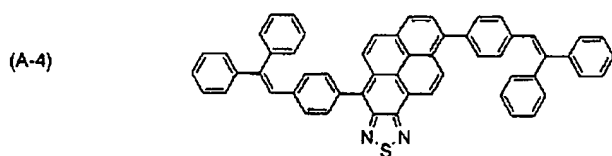
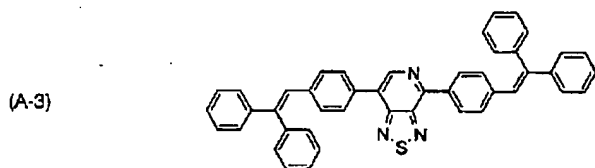
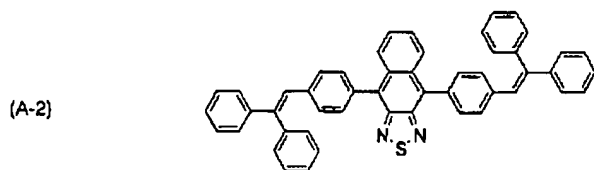
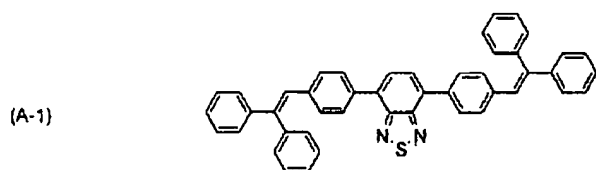
[0053] In addition, when these substituents may form and permute a ring, and a substituent adjoins and

it is contained two or more, these substituents may make cyclic structure unitedly.

[0054] R1 in a general formula (I) and R2 [furthermore,] The aryl group of the carbon numbers 6-20 which may have a hydrogen atom, the alkyl group of carbon numbers 1-6, and a substituent respectively and independently, The alkoxy group of carbon numbers 1-6, the aryloxy group of the carbon numbers 5-18 which may have a substituent, The amino group permuted by the aralkyloxy radical of carbon numbers 7-18, and the aryl group of the carbon numbers 5-16 which may have a substituent, It is a nitro group, a cyano group, the ester group of carbon numbers 1-6, a halogen atom, etc., and these examples are above Ar1 -Ar7. It is the same as that of the substituent which you may have. This R1 and R2 It may be mutually the same and you may differ.

[0055] In addition, R1 and R2 As a substituent which you may have, the alkyl group of carbon numbers 1-6, the alkenyl radical of carbon numbers 1-6, the alkoxy group of carbon numbers 1-6, a cyano group, a silyl radical, a styryl radical, etc. are mentioned.

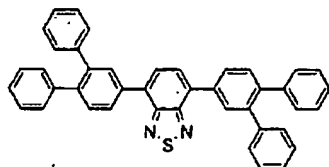
[0056] As an organic compound expressed with said general formula (I), it is [Formula 24], for example.



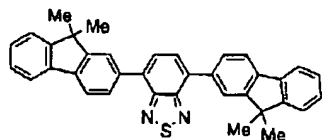
[0057]

[Formula 25]

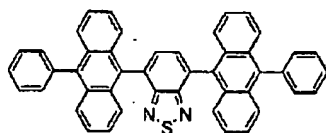
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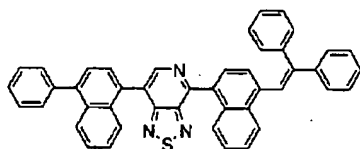
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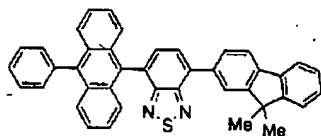
(A-8)



(A-9)



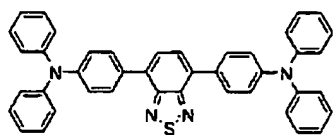
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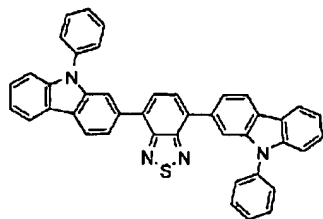
[0058]

[Formula 26]

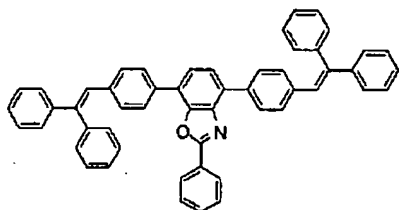
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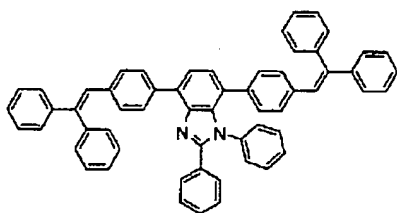
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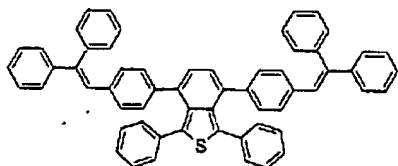
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(A-14)

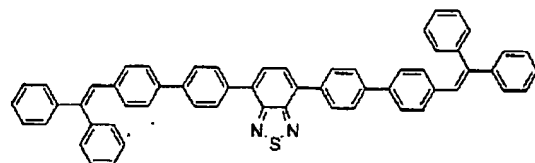
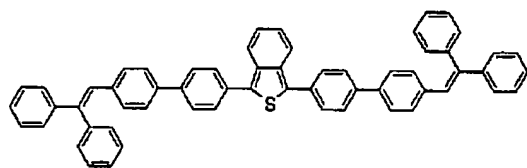
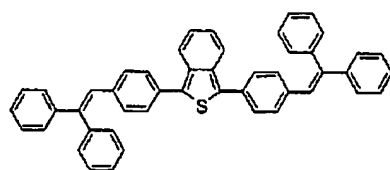
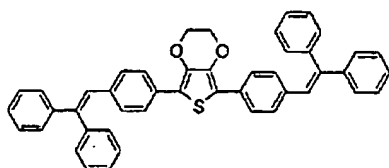
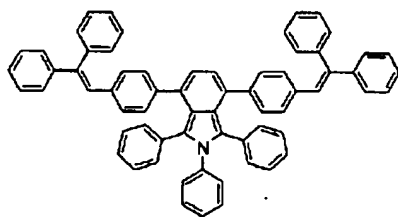


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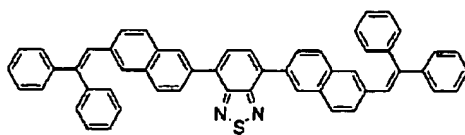
[0059]

[Formula 27]

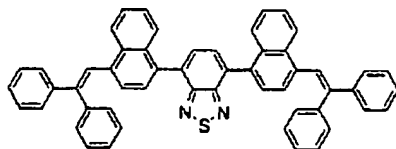


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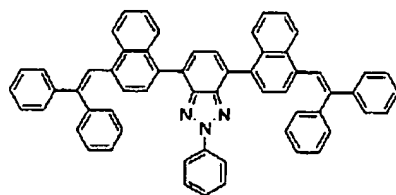
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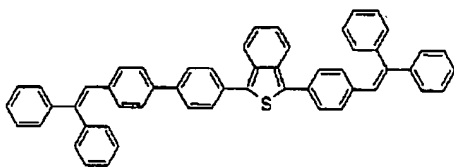
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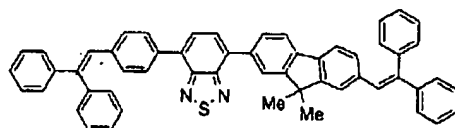
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(A-24)



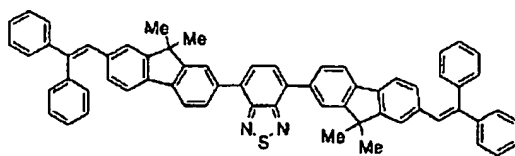
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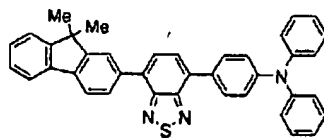
[0061]

[Formula 29]

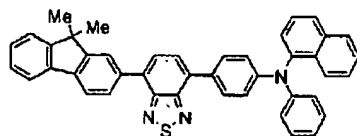
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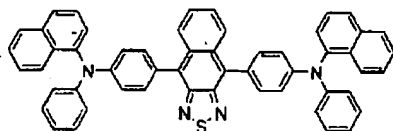
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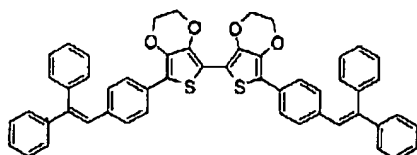
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(A-29)



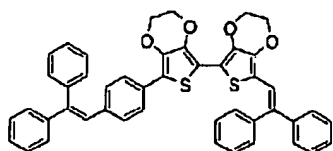
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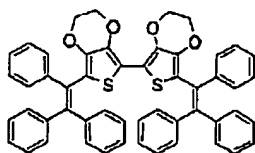
[0062]

[Formula 30]

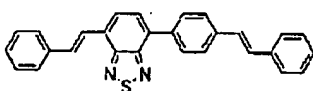
(A-31)



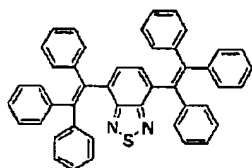
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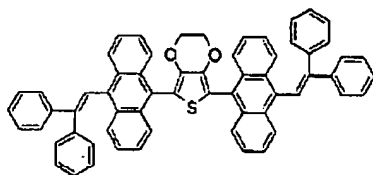
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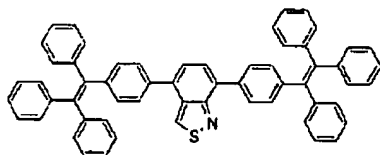
(A-34)



(A-35)



(A-36)



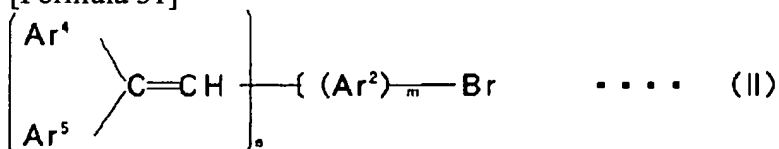
[0063] It can come out and the compound expressed can be mentioned.

[0064] Although there is especially no limit as the manufacture approach of an organic compound expressed with the general formula (I) of this invention and various approaches can be used, the desired poly arylene derivative can be efficiently manufactured by the approach shown below, for example.

[0065] When the example in $\text{Ar}2 = \text{Ar}3$, $\text{Ar}4 = \text{Ar}5 = \text{Ar}6 = \text{Ar}7$ and $m = n$, $w = 1$, and $\text{R}1 = \text{R}2 = \text{H}$ is explained in a general formula (I), it is a general formula (II).

[0066]

[Formula 31]



[0067] (-- Ar², Ar⁴, Ar⁵, and m and s are the same as the above among a formula.) -- general formula (III) [0068] after changing the halogenated compound expressed into a boron acid compound

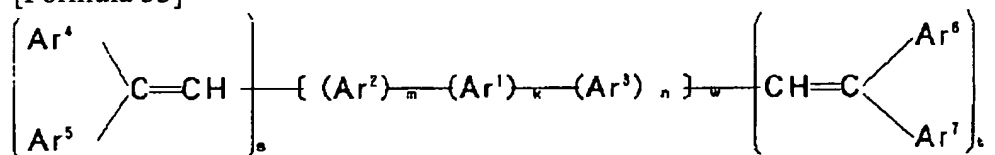
[Formula 32]



[0069] (-- Ar¹ and k are the same as the above among a formula.) -- carrying out coupling of the dibromo compound expressed -- general formula (I-a)

[0070]

[Formula 33]



· · · (I-a)

[0071] (-- Ar¹ -Ar⁷, and k, m, n, w, s and t are the same as the above among a formula.) -- the organic compound expressed is obtained efficiently.

[0072] Moreover, by making the halogenated compound expressed with said general formula (II) react with an alkyl lithium reagent etc., it RICHIO-izes and, subsequently (Ar¹), is k. After considering as diol by making it react with a corresponding quinone, a desired organic compound is efficiently obtained also by aromatizing this by the hydroiodic acid, potassium iodide, etc.

[0073] Next, the organic EL device of this invention is a component which has at least the organic luminous layer pinched by inter-electrode [of a pair], and the thing which made the emission band region, especially the organic luminous layer contain said organic compound is suitable for it as this component.

[0074] As a typical component configuration of this organic EL device ** An anode plate / luminous layer / cathode ** anode plate / hole injection layer / luminous layer / cathode ** anode plate / luminous layer / electronic injection layer / cathode ** anode plate / hole injection layer / luminous layer / electronic injection layer / cathode ** anode plate / organic-semiconductor layer / luminous layer / cathode ** anode plate / organic-semiconductor layer / electronic barrier layer Although a /luminous layer / cathode ** anode plate / organic-semiconductor layer / luminous layer / adhesion improvement layer / cathode ** anode plate / hole injection layer / electron hole transportation layer / luminous layer / electronic injection layer / cathode can be mentioned, of course, it is not limited to these.

[0075] In the component configuration of these various kinds, the thing of the configuration of the above-mentioned ** is used preferably. And while the organic compounds expressed with said general formula (I) are these components, an emission band region and the thing which the luminous layer was made to contain especially are mainly used suitably. What is 30 - 100 % of the weight to the whole luminous layer is suitable for the content rate of the above-mentioned organic compound to this luminous layer.

[0076] This organic EL device is usually produced on the substrate of translucency. This translucency substrate is a substrate which supports an organic EL device, and it is desirable about that translucency that that the permeability of the light of a 400-700nm visible region is [that] at 50% or more uses a desirable still smoother substrate.

[0077] As such a translucency substrate, a glass plate, a synthetic-resin plate, etc. are used suitably, for example. Especially as a glass plate, the plate fabricated with soda lime glass, barium strontium content glass, lead glass, aluminosilicate glass, borosilicate glass, barium borosilicate glass, a quartz, etc. is mentioned. Moreover, as a synthetic-resin plate, it is mentioned in plates, such as polycarbonate resin, acrylic resin, polyethylene terephthalate resin, polyether sulfide resin, and Pori Sall John resin.

[0078] Next, what uses the large (4eV or more) metal, the alloy, the electrical conductivity compounds, or such mixture of a work function as electrode material as the above-mentioned anode plate is used preferably. As an example of such electrode material, conductive ingredients, such as metals, such as Au, CuI, ITO (indiumtin oxide) and SnO₂, ZnO, and In-Zn-O, are mentioned. In order to form this anode plate, a thin film can be made to form such electrode material by approaches, such as vacuum deposition and the sputtering method. When taking out luminescence from the above-mentioned luminous layer from an anode plate, as for this anode plate, it is desirable to have the property that the permeability to luminescence of an anode plate becomes larger than 10%. Moreover, the sheet resistance of an anode plate has the desirable following [hundreds of ohms / **]. Furthermore, although the thickness of an anode plate is based also on an ingredient, it is usually preferably chosen in 10-200nm 10nm - 1 micrometer.

[0079] And as a luminous layer of the organic EL device of this invention, the thing having the following functions is suitable.

[0080] Impregnation function; ** An electron hole can be poured in from an anode plate or a hole injection layer at the time of electric-field impression. The function ** transportation function in which an electron can be poured in from cathode or an electronic injection layer; The place of the recombination of a function ** luminescence function; electron and an electron hole to which the poured-in charge (an electron and electron hole) is moved by the force of electric field is offered. Although size may be in the transportation ability which the function to tie this to luminescence, however an electron hole are poured in, easy and an electron are poured in, and there may be a difference in easy, and is expressed with the mobility of an electron hole and an electron, it is desirable to move one of charges. The JISUCHIRU arylene derivative expressed with said general formula (I) fulfills the three above-mentioned conditions, forms the luminous layer which is mainly concerned with this, and can carry out the thing of it.

[0081] Moreover, a recombination site morphogenetic substance can be used as a part of component of the luminous layer of this organic EL device. The recombination of the matter which offers positively the location which the electron with which this recombination site morphogenetic substance was poured in from two poles, and an electron hole recombine, respectively or an electron, and an electron hole itself is the matter which offers the location which is spread by recombination energy and emits light, although not generated. Therefore, by adding this recombination site morphogenetic substance, rather than the case of independent use of said poly arylene derivative, an electron and an electron hole can be made to be able to recombine near the center of a luminous layer intensively, and the luminescence brightness in a luminous layer can be raised further.

[0082] Since it is such, as a recombination site morphogenetic substance used for the component of the luminous layer of the organic EL device of this invention, a thing with the high fluorescence quantum yield is desirable, and that the value of whose is 0.3-1.0 especially is suitable. As such a recombination site morphogenetic substance, a kind or two sorts or more of mixture chosen from a styryl amine system compound, the Quinacridone derivative, the rubrene derivative, the coumarin derivative, and the pyran derivative is mentioned. Moreover, as this recombination site morphogenetic substance, a conjugated-system high molecular compound can be used and the poly arylene vinylene derivative, the poly arylene of the alkyl group permutation of carbon numbers 1-50 or an alkoxy group permutation, a vinylene derivative, etc. are mentioned especially.

[0083] Moreover, these recombination site morphogenetic substance of things is [choosing in consideration of the color enhancement in a luminous layer] also desirable. For example, when asking for blue coloring, it is desirable perylene and to use an amino permutation JISUCHIRIRU arylene derivative etc. And when asking for green coloring, it is desirable to use the Quinacridone derivative or a coumarin derivative. Moreover, when asking for yellow coloring, it is desirable to use a rubrene derivative etc. Furthermore, when asking for orange or a red lamp color, it is desirable to use a dicyano methyl pyran derivative etc.

[0084] Moreover, it is also a desirable gestalt to use the organic compound expressed with said general formula (I) of this invention as a recombination site morphogenetic substance. When it is the compound

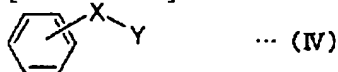
especially chosen from (A-1), (A-3), (A-6), (A-7), (A-11), (A-14), and (A-17), the organic EL device of high quality is obtained and the field from green to red can be realized as the luminescent color.

[0085] In the organic EL device of this invention, although the blending ratio of coal of said recombination site morphogenetic substance is defined in consideration of the luminescence brightness and color enhancement of a luminous layer, specifically, it is desirable to consider as the value of 0.1 - 20 weight section within the limits to said organic compound 100 weight section. There is an inclination for luminescence brightness to fall that the loadings of this recombination site morphogenetic substance are under the 0.1 weight section, and on the other hand, when 20 weight sections are exceeded, there is an inclination for endurance to fall. Therefore, in order to more often maintain the balance of the luminescence brightness and endurance in an organic EL device, it is good for making this blending ratio of coal into 0.5 - 20 weight section to said organic compound 100 weight section to make this value 1.0 - 10 weight section desirable still more preferably.

[0086] As for the ingredient which forms the organic luminous layer of this organic EL device, the following compounds are used according to the color tone of a request besides the above. For example, when obtaining purple luminescence from an ultraviolet area, the compound expressed with a general formula (IV) is used suitably.

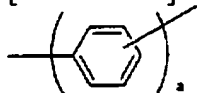
[0087]

[Formula 34]



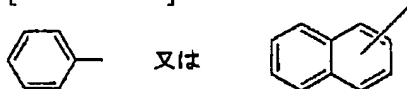
[0088] (The inside of a formula and X are a general formula [0089].)

[Formula 35]



[0090] (a shows the integer of 2-5.) -- the radical of the bivalence expressed -- being shown -- Y --

[0091]
[Formula 36]

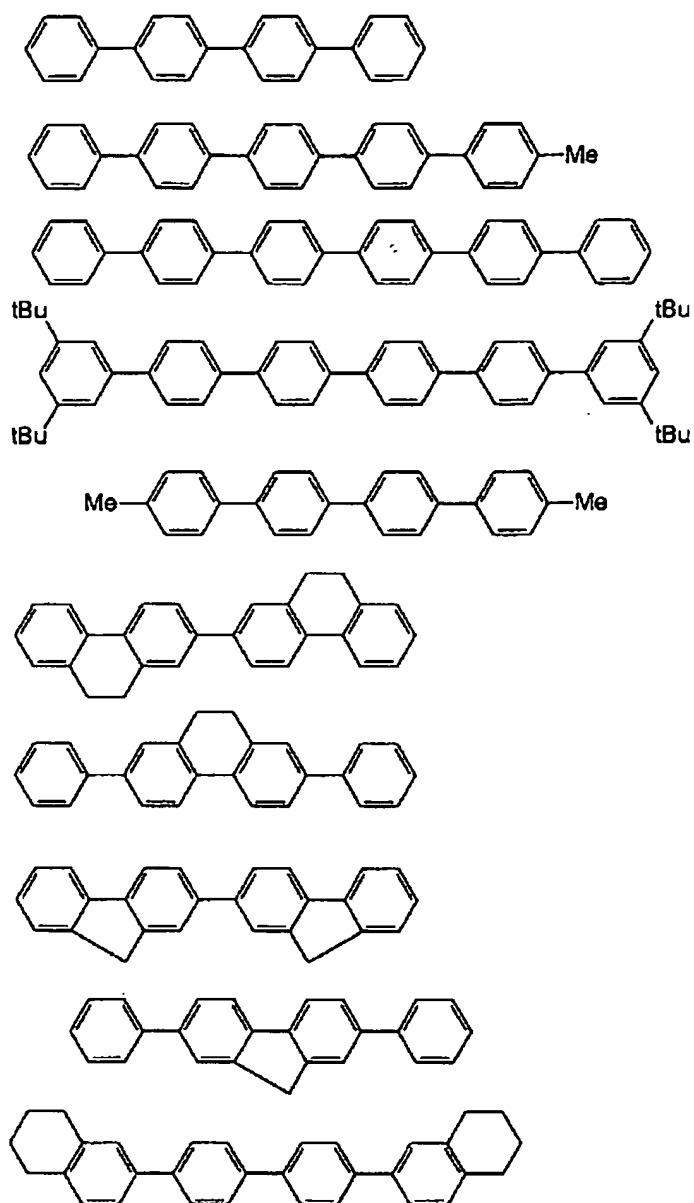


[0092] It comes out and the aryl group expressed is shown.

[0093] An unit or two or more substituents, such as the alkyl group of carbon numbers 1-4, the alkoxy group of carbon numbers 1-4, a hydroxyl group, a sulfonyl group, a carbonyl group, an amino group, a dimethylamino radical, or a diphenylamino radical, may be introduced into the phenyl group in the compound expressed with this general formula (IV), the phenylene group, and the naphthyl group. Moreover, when there are two or more these substituents, they may join together mutually and may form saturation 5 membered-ring or six membered-rings. Furthermore, about the gestalt of this compound, it is desirable from being easy to form the vacuum evaporatio no film with it. [affinity good / what was combined with the phenyl group, the phenylene group and the naphthyl group with the para position / and, and] [smooth] It will be as follows if the example of a compound expressed with the above-mentioned general formula (IV) is shown.

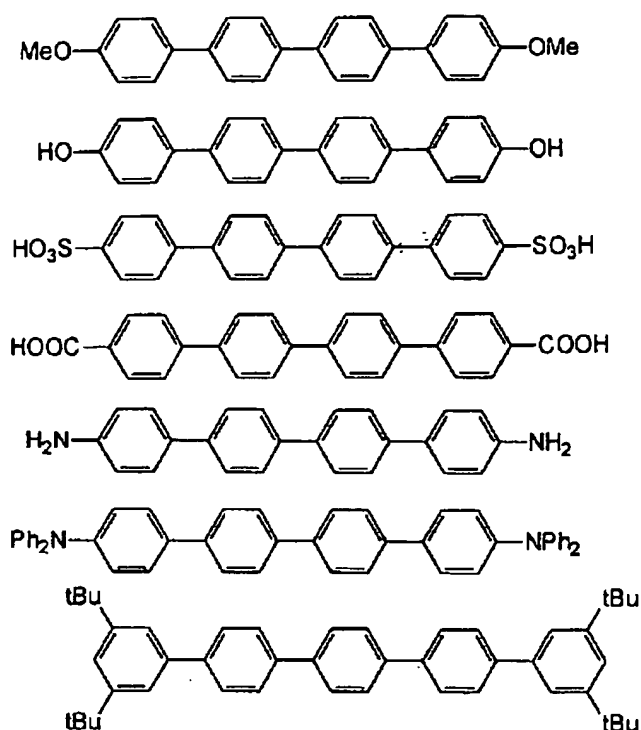
[0094]

[Formula 37]



[0095]

[Formula 38]



[0096] Especially in these compounds, p-quarter phenyl derivative and p-KUINKU phenyl derivative are desirable.

[0097] Moreover, in order to obtain green luminescence from blue, fluorescent brighteners, such as for example, a benzothiazole system, a benzimidazole system, and a benzooxazole system, a metal chelation oxy-NOIDO compound, and a styryl benzenoid compound can be used. As an example of these compounds, the compound currently indicated by JP,59-194393,A, for example can be mentioned. Furthermore, other useful compounds are enumerated by 628-637 pages (1971) of chemistry OBU synthetic soybeans, and 640 pages.

[0098] As said chelation oxy-NOIDO compound, the compound currently indicated by JP,63-295695,A can be used, for example. As the example of representation, it can mention as 8-hydroxyquinoline system metal complexes, such as tris (eight quinolinol) aluminum, and a compound with suitable dilithium EPINTORI dione etc.

[0099] Moreover, as said styryl benzenoid compound, what is indicated by the Europe patent No. 0319881 specification and the Europe patent No. 0373582 specification can be used, for example. And the JISUCHIRIRU pyrazine derivative currently indicated by JP,2-252793,A can also be used as an ingredient of a luminous layer. In addition, the polyphenyl system compound currently indicated by the Europe patent No. 0387715 specification can also be used as an ingredient of a luminous layer.

[0100] Furthermore, in addition to a fluorescent brightener, a metal chelation oxy-NOIDO compound, a styryl benzenoid compound, etc. which were mentioned above Non [for example, / 12-phtalo peri], (J.Appl.Phys., the 27th volume, L713 (1988)) 1, 4-diphenyl-1,3-butadiene, 1, 1 and 4, and 4-tetra-phenyl-1,3-butadiene (above Appl. Phys. Lett., the 56th volume, L799 (1990)), The North America Free Trade Agreement RUIMIDO derivative (JP,2-305886,A), a perylene derivative (JP,2-189890,A), An OKISA diazole derivative (JP,2-216791,A or OKISA diazole derivative indicated by Hamada and others at the 38th applied-physics relation union lecture meeting), An aldazine derivative (JP,2-220393,A), a PIRAJIRIN derivative (JP,2-220394,A), A cyclopentadiene derivative (JP,2-289675,A), a pyrrolo pyrrole derivative (JP,2-296891,A), a styryl amine derivative (Appl.Phys.Lett., the 56th volume, and L799 (1990) --) A coumarin system compound (JP,2-191694,A), the international patent official report WO 90/13148, Appl.Phys.Lett., vol 58 and 18, a high molecular compound that is indicated by P1982 (1991) can be used as an ingredient of a luminous layer.

[0101] It is desirable to use an aromatic series JIMECHIRI DIN system compound (thing of the

indication to the Europe patent No. 0388768 specification or JP,3-231970,A) as an ingredient of a luminous layer especially in this invention. As an example, a - bis(2 and 2-G t-buthylphenyl vinyl) biphenyl, and 4 and 4 '4, 4'-bis(2 and 2-diphenyl vinyl) biphenyl etc. can mention those derivatives. [0102] Moreover, the inside of the general formula (Rs-Q) 2-aluminum-O-L[type indicated by JP,5-258862,A etc., L is the hydrocarbon of 6-24 carbon atoms which come to contain a phenyl part. O-L is a phenolate ligand and Q shows a permutation 8-quinolate ligand. The compound expressed with] which shows 8-quinolate ring substituent chosen so that it might block in three dimensions that a permutation 8-quinolate ligand exceeds two pieces in an aluminum atom, and Rs combines with it is also mentioned. Specifically, bis(2-methyl-8-quinolate) (Para-phenyl phenolate) aluminum (III), bis(2-methyl-8-quinolate) (1-naphth RATO) aluminum (III), etc. are mentioned.

[0103] In addition, the method of obtaining the efficient blue using doping by JP,6-9953,A etc. and mixed green luminescence is mentioned. In this case, as a host, the same fluorochrome as what is used as the above-mentioned host, the strong fluorochrome, for example, the coumarin system, of from blue until green or, can be mentioned as the above-mentioned luminescent material and a dopant. concrete -- as a host -- the luminescent material of a JISUCHIRIRU arylene frame -- especially -- desirable -- as a 4 and 4'-bis(2 and 2-diphenyl vinyl) biphenyl and a dopant -- diphenylamino vinyl arylene -- N and N-diphenylamino vinylbenzene can be mentioned especially preferably.

[0104] The following can be used although there is especially no limit as a luminous layer which obtains white luminescence.

** The thing which specifies the energy level of each class of the organic electroluminescence laminating structure, and is made to emit light using tunnel impregnation (the Europe patent No. 0390551 official report).

That the white light emitting device is indicated to be as an example with the component which uses tunnel impregnation as well as ***** (JP,3-230584,A).

** That the luminous layer of the two-layer structure is indicated to be (JP,2-220390,A and JP,2-216790,A).

** What consisted of ingredients with which a luminous layer is divided into plurality and luminescence wavelength differs, respectively (JP,4-51491,A).

** The thing of a configuration of having carried out the laminating of a blue emitter (380-480nm of fluorescence peaks) and the green emitter (480-580nm), and having made the red fluorescent substance contain further (JP,6-207170,A).

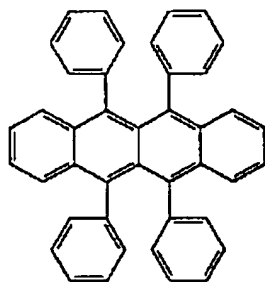
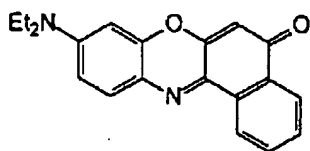
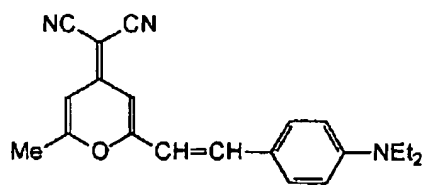
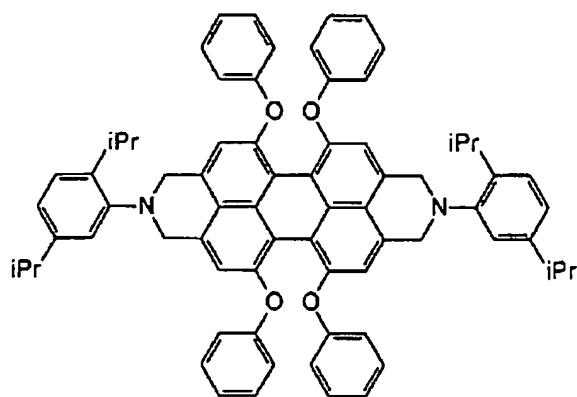
** The thing of a configuration of having the field where the blue luminous layer contained the blue fluorochrome, and the green luminous layer contained the red fluorochrome, and containing a green fluorescent substance further (JP,7-142169,A).

In these, especially the thing of the configuration of the above-mentioned ** is desirable.

[0105] Furthermore, as a red fluorescent substance, what is shown below is used suitably.

[0106]

[Formula 39]



[0107] next -- as the approach of forming a luminous layer using the above-mentioned ingredient -- vacuum deposition, a spin coat method, and LB -- well-known approaches, such as law, are applicable. As for especially a luminous layer, it is desirable that it is the molecule deposition film. the thing of the thin film which deposition was carried out to the molecule deposition film from the ingredient compound of a gaseous-phase condition here, and was formed, and the film solidified and formed from the ingredient compound of a solution condition or a liquid phase condition -- it is -- usually -- this molecule deposition film -- LB -- with the thin film (molecule built up film) formed of law, it is classifiable with the difference of condensation structure and higher order structure, and the functional difference resulting from it.

[0108] Moreover, after melting a binder and ingredient compounds, such as resin, to a solvent and considering as a solution as indicated by JP,57-51781,A, a luminous layer can be formed also by thin-film-izing this with a spin coat method etc.

[0109] Thus, although there is especially no limit about the thickness of the luminous layer formed and it can choose suitably according to a situation, the range of 5nm - 5 micrometers is usually desirable. This luminous layer may consist of one layer which consists of one sort of the ingredient mentioned above, or two sorts or more, and may carry out the laminating of the luminous layer which consists of a compound of another kind to said luminous layer.

[0110] Next, it is a layer which helps the hole injection to a luminous layer and is conveyed to a luminescence field, a hole injection and a transportation layer have large hole mobility, and its ionization energy is usually as small as 5.5eV or less. The ingredient which conveys an electron hole to a luminous layer with the lower field strength as such a hole injection and a transportation layer is desirable, and that whose mobility of an electron hole is $10^{-6} \text{cm}^2/\text{V}$, and a second at least at the time of electric-field impression of $10^4 - 10^6 \text{V/cm}$ is still more desirable. If it has the aforementioned desirable property as an ingredient which is mixed with the JISUCHIRIRU arylene derivative of this invention, and forms a hole injection and a transportation layer, there is especially no limit, and it can choose and use the thing of arbitration conventionally out of what is commonly used as a charge transportation ingredient of an electron hole in photoconductive material, and the well-known thing currently used for the hole injection layer of an organic EL device.

[0111] As a formation ingredient of such a hole injection and a transportation layer Specifically For example, a triazole derivative (reference, such as a U.S. Pat. No. 3,112,197 number specification), An OKISA diazole derivative (reference, such as a U.S. Pat. No. 3,189,447 number specification), an imidazole derivative (reference, such as JP,37-16096,B) and the poly aryl alkane derivative (a U.S. Pat. No. 3,615,402 number specification --) A 3,820,989 specification, a 3,542,544 specification, JP,45-555,B, a 51-10983 official report, JP,51-93224,A, A 55-17105 official report, a 56-4148 official report, a 55-108667 official report, Reference, such as a 55-156953 official report and a 56-36656 official report, a pyrazoline derivative and a pyrazolone derivative (a U.S. Pat. No. 3,180,729 specification --) A 4,278,746 specification, JP,55-88064,A, A 55-88065 official report, a 49-105537 official report, a 55-51086 official report, A 56-80051 official report, a 56-88141 official report, a 57-45545 official report, Reference, such as a 54-112637 official report and a 55-74546 official report, a phenylenediamine derivative (a U.S. Pat. No. 3,615,404 specification --) JP,51-10105,B, a 46-3712 official report, a 47-25336 official report, Reference, such as JP,54-53435,A, a 54-110536 official report, and a 54-119925 official report, an arylamine derivative (a U.S. Pat. No. 3,567,450 specification and a 3,180,703 specification --) A 3,240,597 specification, a 3,658,520 specification, A 4,232,103 specification, a 4,175,961 specification, A 4,012,376 specification, JP,49-35702,B, A 39-27577 official report, JP,55-144250,A, a 56-119132 official report, Reference, such as a 56-22437 official report and the West German patent No. 1,110,518 specification, An amino permutation chalcone derivative (reference, such as a U.S. Pat. No. 3,526,501 specification), An oxazole derivative (thing of an indication on U.S. Pat. No. 3,257,203 specifications etc.), A styryl anthracene derivative (reference, such as JP,56-46234,A), full -- me -- non -- a derivative (reference, such as JP,54-110837,A) and a hydrazone derivative (a U.S. Pat. No. 3,717,462 specification --) JP,54-59143,A, a 55-52063 official report, a 55-52064 official report, A 55-46760 official report, a 55-85495 official report, a 57-11350 official report, Reference, such as a 57-148749 official report and JP,2-311591,A, a stilbene derivative (JP,61-210363,A and this No. 228451 [61 to] official report --) A 61-14642 official report, a 61-72255 official report, a 62-47646 official report, A 62-36674 official report, a 62-10652 official report, a 62-30255 official report, A 60-93455 official report, a 60-94462 official report, a 60-174749 official report, Reference, silazane derivatives (U.S. Pat. No. 4,950,950 specification), such as a 60-175052 official report, The conductive polymer oligomer (especially thiophene oligomer) currently indicated by a polysilane system (JP,2-204996,A), an aniline system copolymer (JP,2-282263,A), and JP,1-211399,A can be mentioned.

[0112] Although the above-mentioned thing can be used as an ingredient of a hole injection and a transportation layer A porphyrin compound (thing of the indication to JP,63-2956965,A etc.), an aromatic series tertiary-amine compound and a styryl amine compound (a U.S. Pat. No. 4,127,412 specification --) JP,53-27033,A, a 54-58445 official report, a 54-149634 official report, A 54-64299 official report, a 55-79450 official report, a 55-144250 official report, Reference and aromatic series tertiary-amine compounds, such as a 56-119132 official report, a 61-295558 official report, a 61-98353 official report, and a 63-295695 official report, can also be used.

[0113] moreover -- U.S. Pat. No. 5,061,569 -- indicating -- having -- **** -- two -- a piece -- a fused aromatic ring -- intramolecular -- having -- for example, -- four -- four -- ' - a screw (N-(1-naphthyl)-N-phenylamino) -- a biphenyl -- moreover -- JP,4-308688,A -- indicating -- having -- **** -- a

triphenylamine -- a unit -- three -- a ** -- a starburst -- a mold -- connecting -- having had -- four -- four -- ' -- four -- " - tris (N-(3-methylphenyl)-N-phenylamino) -- a triphenylamine -- etc. -- it can mention . Furthermore, inorganic compounds, such as the p mold Si besides the above-mentioned aromatic series JIMECHIRI DIN system compound shown as an ingredient of a luminous layer and the p mold SiC, can also be used as an ingredient of a hole injection and a transportation layer.

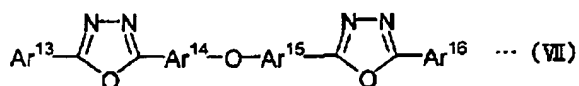
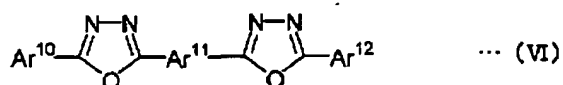
[0114] and -- for forming this hole injection and transportation layer -- an above-mentioned compound - - for example, a vacuum deposition method, a spin coat method, the cast method, and LB -- what is necessary is just to thin-film-ize by well-known approaches, such as law In this case, the thickness as a hole injection and a transportation layer is usually 5nm - 5 micrometers, although there is especially no limit. As long as this hole injection and transportation layer contain the aromatic hydrocarbon compound of this invention in the electron hole transportation band, it may consist of one layer which consists of one sort of the ingredient mentioned above, or two sorts or more, and may carry out the laminating of the hole injection and the transportation layer which consists of a compound of another kind to said hole injection and transportation layer.

[0115] Moreover, an organic-semiconductor layer is a layer which helps the hole injection or electron injection to a luminous layer, and what has the conductivity more than 10⁻¹⁰ S/cm is suitable for it. As an ingredient of such an organic-semiconductor layer, conductive DIN DORIMA, such as conductive oligomer, such as ** thiophene oligomer and ** arylamine oligomer given in JP,8-193191,A, and ** arylamine DIN DORIMA, etc. can be used.

[0116] Next, an electronic injection layer is a layer which helps impregnation of the electron to a luminous layer, and its electron mobility is large, and an adhesion improvement layer is a layer which especially adhesion with cathode becomes from a good ingredient in this electronic injection layer. As an ingredient used for an electronic injection layer, the metal complex of 8-hydroxyquinoline or its derivative is suitable. As an example of the metal complex of the above-mentioned 8-hydroxyquinoline or its derivative, the metal chelate oxy-NOIDO compound containing the chelate of an oxine (generally an eight quinolinol or 8-hydroxyquinoline), for example, tris (eight quinolinol) aluminum, can be used as an electron injection ingredient.

[0117] And as an OKISA diazole derivative, they are the following general formula (V) - (VII) [0118].

[Formula 40]



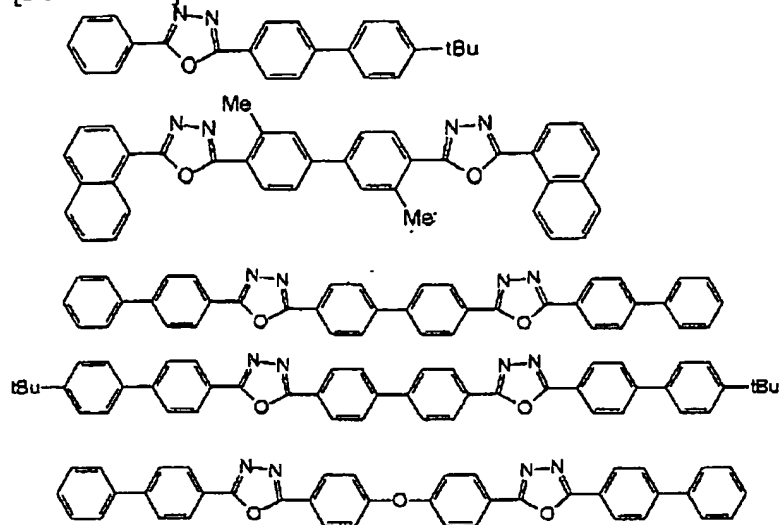
[0119] (The aryl group which it does not have or Ar₈, Ar₉, and Ar₁₀, Ar₁₂, Ar₁₃ and Ar₁₆ have a substituent, respectively is shown among a formula, and even if Ar₁₀, and Ar₁₂, Ar₁₃ and Ar₁₆ are mutually the same, they may differ.) [Ar₈, Ar₉, and] The arylene radical which it does not have or Ar₁₁, Ar₁₄, and Ar₁₅ have a substituent, respectively is shown, and even if Ar₁₄ and Ar₁₅ are mutually the same, they may differ. The electron transport compound expressed is mentioned.

[0120] As an aryl group in these general formulas (V) - (VII), a phenyl group, a biphenyl radical, an anthranil, a peri RENIRU radical, a pyrenyl radical, etc. are mentioned. Moreover, as an arylene radical, a phenylene group, a naphthylene radical, a biphenylene radical, an anthra NIREN radical, a peri RENIREN radical, a pyrenylene radical, etc. are mentioned. And as a substituent to these, the alkyl group of carbon numbers 1-10, the alkoxy group of carbon numbers 1-10, or a cyano group is mentioned. What has a thin film plasticity good [this electron transport compound] is used preferably.

[0121] And the following can be mentioned as an example of these electron transport nature compound.

[0122]

[Formula 41]



[0123] Next, what uses the small (4eV or less) metal, the alloy, the electrical conductivity compounds, and such mixture of a work function as electrode material as cathode is used. As an example of such electrode material, a sodium and sodium-potassium alloy, magnesium, a lithium, magnesium and a silver alloy, aluminum/aluminum oxide, aluminum/Li₂O, aluminum/LiO₂, aluminum/LiF, an aluminium-lithium alloy, an indium, a rare earth metal, etc. are mentioned. By making a thin film form by approaches, such as vacuum evaporation and sputtering, this cathode can produce such electrode material.

[0124] Here, when taking out luminescence from a luminous layer from cathode, as for the permeability to luminescence of cathode, it is desirable to make it larger than 10%. Moreover, below hundreds of ohms / ** of the sheet resistance as cathode are desirable, and 10nm - 1 micrometer of thickness is usually 50-200nm preferably further.

[0125] Next, what is necessary is to form an electronic injection layer a hole injection layer and if needed an anode plate, a luminous layer, and if needed by an above-mentioned ingredient and an above-mentioned approach, and just to form cathode finally about the approach of producing the organic EL device of this invention. Moreover, an organic EL device is also producible from cathode by the above and the reverse order to an anode plate.

[0126] Hereafter, the example of production of the organic EL device of a configuration of that an anode plate / hole injection layer / luminous layer / electronic injection layer / cathode was prepared one by one on the translucency substrate is explained.

[0127] First, on a suitable translucency substrate, 1 micrometer or less, the thin film which consists of an anode material is formed by vacuum deposition or the sputtering method, and let it be an anode plate so that you may become the thickness of the range of 10-200nm preferably. Next, a hole injection layer is formed on this anode plate. formation of a hole injection layer was mentioned above -- as -- a vacuum deposition method, a spin coat method, the cast method, and LB -- although it can carry out by approaches, such as law, it is desirable to form with a vacuum deposition method from the point of the homogeneous film being easy to be obtained and being hard to generate a pinhole. Although the vacuum evaporation condition changes with the crystal structures, recombination structures, etc. of the compound (ingredient of a hole injection layer) to be used, and the hole injection layer made into the purpose when forming a hole injection layer with a vacuum deposition method, it is desirable to choose suitably generally in the source temperature of vacuum evaporation of 50-450 degrees C, a degree of vacuum 10⁻⁷ - 10⁻³torr, the evaporation rate of 0.01-50nm/second, the substrate temperature of -50-300 degrees C, and the range of 5nm - 5 micrometers of thickness.

[0128] Next, a luminous layer is prepared on this hole injection layer. Although formation of this luminous layer can also be formed by thin-film-izing organic luminescent material using a desired organic luminescent material by approaches, such as a vacuum deposition method, sputtering, a spin coat method, and the cast method, it is desirable to form with a vacuum deposition method from the point of the homogeneous film being easy to be obtained and being hard to generate a pinhole. Although the vacuum evaporation condition changes with compounds to be used when forming a luminous layer with a vacuum deposition method, generally it can choose from the same condition range as formation of a hole injection layer.

[0129] Next, an electronic injection layer is formed on this luminous layer. Also in this case, it is desirable to form with a vacuum deposition method from the need of obtaining the homogeneous film, like a hole injection layer and a luminous layer. Vacuum evaporation conditions can be chosen from the same condition range as a hole injection layer and a luminous layer.

[0130] Although the JISUCHIRIRU arylene derivatives of this invention differ by whether which layer of the above-mentioned organic compound layer is made to contain, when using a vacuum deposition method, they can carry out vapor codeposition with other ingredients. Moreover, when using a spin coat method, it can be made to contain by mixing with other ingredients.

[0131] And the laminating of the cathode can be carried out to the last, and an organic EL device can be obtained. Cathode consists of metals and can use vacuum deposition and sputtering. However, in order to protect the organic layer of a substrate from the damage at the time of film production, a vacuum deposition method is desirable.

[0132] Production of the above organic EL device is one vacuum suction, and it is desirable to produce from an anode plate to cathode consistently.

[0133] Luminescence can be observed, if an anode plate is made into +, cathode is made into the polarity of - and the electrical potential difference of 3-40V is impressed, when impressing direct current voltage to this organic EL device. Moreover, even if it impresses an electrical potential difference with a reverse polarity, a current does not flow, and luminescence is not produced at all. Furthermore, uniform luminescence is observed, only when alternating voltage is impressed, an anode plate becomes + and cathode becomes the polarity of -. In this case, the wave of the alternating current to impress is arbitrary and good.

[0134]

[Example] Next, although an example explains this invention to a detail further, this invention is not limited at all by these examples.

Dibromo benzothiadiazole 5g (17 millimol), 15g [of 4-(2 and 2-diphenyl vinyl) phenyl boron acids] (50 millimol), and tetrakis(triphenyl phosphine)palladium 0.8g (0.7 millimol) was melted to toluene 100ml under example 1 (composition of compound A -1) argon atmosphere, 11g (0.10 millimol r) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 8.3g (76% of yield) of yellow solid-states was obtained.

[0135] The ultimate analysis value about this thing and the measurement result of a field desorption mass spectrum (FD-MS) are as follows.

Elemental-analysis Value (%): Calculated value as C;85.60, H; 5.03, and N;4.30C₄₆H₃₂N₂ S (%); Molecular weight calculated as C; 85.68, H; 5.00, N;4.34FD-MS:m / z= 644 (M+, 100), and C₄₆H₃₂N₂ S = 644 [0136] Dibromo aza-benzothiadiazole 5g (17 millimol), 15g [of 4-(2 and 2-diphenyl vinyl) phenyl boron acids] (50 millimol), and tetrakis(triphenyl phosphine)palladium 0.8g (0.7 millimol) was melted to toluene 100ml under example 2 (composition of compound A -3) argon atmosphere, 11g (0.10 millimol r) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 7.1g (65% of yield) of yellow solid-states was obtained.

[0137] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis value: Calculated value as C; 83.39, H; 5.09, and N;6.80C₄₆H₃₁N₃ S (%);

Molecular weight =645 example 3 (composition of compound A -6) calculated as C; 83.69, H; 4.84,

N;6.51 FD-MS:m/z=645 (M+, 100), and C₄₆H₃₁N₃ S

Dibromo benzothiadiazole [5] (17 millimol) and 3, 13.7g [of 4-diphenyl vinyl phenyl boron acids] (50 millimol), and tetrakis(triphenyl) phosphinepalladium 0.8g (0.7 millimol) was melted to toluene 100ml under argon atmosphere, 11g (0.10 millimol) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 9.2g (91% of yield) of yellow solid-states was obtained.

[0138] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis Value (%): Calculated value as C;85.42, H; 4.71, and N;5.00C₄₂H₂₈N₂ S (%); Molecular weight =592 example 4 (composition of compound A -7) calculated as C; 85.10, H; 4.76, N;4.73 FD-MS:m/z=592 (M+, 100), and C₄₂H₂₈N₂ S

Dibromo benzothiadiazole [5] (17 millimol) and 9, 12g [of 9-dimethyl fluorene-2-boron acids] (50 millimol), and tetrakis(triphenyl) phosphinepalladium 0.8g (0.7 millimol) was melted to toluene 100ml under argon atmosphere, 11g (0.10 millimol) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 7.7g (87% of yield) of yellow solid-states was obtained.

[0139] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis Value (%): Calculated value as C;82.75, H; 5.12, and N;5.47C₃₆H₂₈N₂ S (%); Molecular weight =520 example 5 (composition of compound A -11) calculated as C; 83.04, H; 5.42, N;5.38 FD-MS:m/z=520 (M+, 100), and C₄₂H₂₈N₂ S

Dibromo benzothiadiazole 5g (17 millimol), 4.9g [of 4-diphenylamino phenyl boron acids] (50 millimol), and tetrakis(triphenyl) phosphinepalladium 0.8g (0.7 millimol) was melted to toluene 100ml under argon atmosphere, 11g (0.10 millimol) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 5.9g (56% of yield) of yellow solid-states was obtained.

[0140] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis Value (%): Calculated value as C;80.09, H; 5.01, and N;8.67C₄₂H₃₀N₄ S (%); C; 81.00, H; 4.86, N;9.00 FD-MS:m/z=622 (M₂+, 3) (M+, 100), Molecular weight calculated as C₄₂H₃₀N₂ N₄ S = Under 622 example 6 (composition of compound A -14) argon atmosphere, Dibromo diphenyl benzimidazole 7.3g (17 millimol), 15g (50 millimol) of 4-(2 and 2-diphenyl vinyl) phenyl boron acids, Tetrakis(triphenyl) phosphinepalladium 0.8g (0.7 millimol) was melted to toluene 100ml, 11g (0.10 millimol) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 7.0g (53% of yield) of yellow solid-states was obtained.

[0141] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis Value (%): C;90.62, H; 5.03, and N;3.55C₅₉H₄₂N₂ Calculated value to carry out (%);

C; 90.97, H; 5.43, N;3.60 FD-MS:m/z=778 (M+, 100), C₅₉H₄₂N₂ Under the molecular weight =778 example 7 (composition of compound A -17) argon atmosphere which calculated by carrying out, Ethylene dioxy dibromo thiophene 5.1g (17 millimol), 15g (50 millimol) of 4-(2 and 2-diphenyl vinyl) phenyl boron acids, Tetrakis(triphenyl) phosphinepalladium 0.8g (0.7 millimol) was melted to toluene 100ml, 11g (0.10 millimol) of carbonic acid NATORIMMU water solutions was added, and it flowed back for 12 hours. The produced solid-state was carried out the ** exception, it recrystallized [toluene], and 7.3g (66% of yield) of yellow solid-states was obtained.

[0142] The elemental-analysis value about this thing and FD-MS are as follows.

Elemental-analysis Value (%): Calculated value as C;85.01 and H;5.01C₄₆H₃₄O₂ S (%);

The transparency anode of the indium stannic-acid ghost film of 100nm of thickness was prepared on the glass substrate of the molecular weight =650 example 8(production of organic EL device) 25mmx75mmx1.1mm size calculated as C; 84.89, H;5.27 FD-MS:m/z=650 (M+, 100), and C₄₆H₃₄O₂ S. Ultraviolet rays and ozone were used together and this was washed for 10 minutes.

[0143] This glass substrate was put into the vacuum evaporation system [the product made from Japanese Vacuum technology], and it decompressed to about ten to 4 Pa. TPD74 which has the

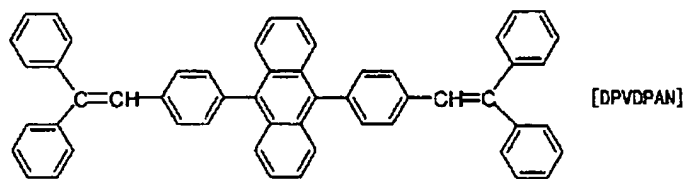
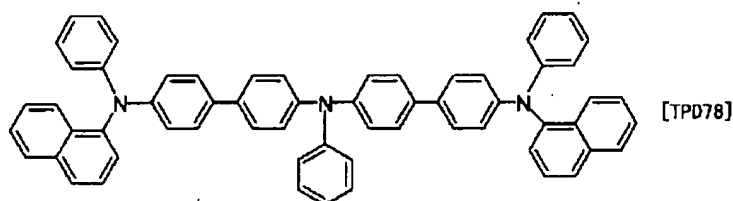
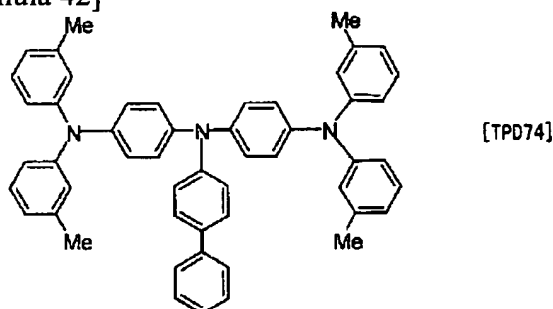
following structure in this was vapor-deposited in thickness of 60nm with the evaporation rate of 0.2nm/second. Subsequently, TPD78 which has the following structure was vapor-deposited in thickness of 20nm with the evaporation rate of 0.2nm/second.

[0144] Next, the coincidence vacuum evaporation of DPVDPAN and the compound (A-1) of the following structure was carried out, and the luminous layer with a thickness of 40nm was formed. The evaporation rate of DPVDPAN in this case was 0.4nm/second, and the evaporation rate of a compound (A-1) was 0.01nm/second. Furthermore, cathode was formed by the thickness of 150nm by vapor-depositing tris (eight quinolinol) aluminum (Alq) with the evaporation rate of 0.2nm/second, and carrying out the coincidence vacuum evaporation of aluminum and the lithium at the last. Under the present circumstances, the evaporation rate of aluminum was 1nm/second, and the evaporation rate of a lithium was 0.004nm/second.

[0145] The engine performance of the obtained organic EL device is shown in the 1st table.

[0146]

[Formula 42]



[0147] In example 9 example 8, the organic EL device was produced like the example 8 instead of the compound (A-1) except having used the compound (A-3). The engine performance of this thing is shown in the 1st table.

In example 10 example 8, the organic EL device was produced like the example 8 instead of the compound (A-1) except having used the compound (A-6). The engine performance of this thing is shown in the 1st table.

In example 11 example 8, the organic EL device was produced like the example 8 instead of the compound (A-1) except having used the compound (A-7). The engine performance of this thing is shown in the 1st table.

In example 12 example 8, the organic EL device was produced like the example 8 instead of the compound (A-1) except having used the compound (A-11). The engine performance of this thing is shown in the 1st table.

In example 13 example 8, the organic EL device was produced like the example 8 instead of the

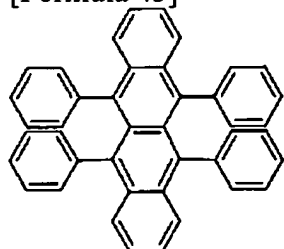
compound (A-1) except having used the compound (A-14). The engine performance of this thing is shown in the 1st table.

In example 14 example 8, the organic EL device was produced like the example 8 instead of the compound (A-1) except having used the compound (A-17). The engine performance of this thing is shown in the 1st table.

In example 15 example 8, the organic EL device was produced like the example 8 except having used the compound (A-1) instead of DPVDPAN, and having used the rubrene of the following structure instead of the compound (A-1). The engine performance of this thing is shown in the 1st table.

[0148]

[Formula 43]



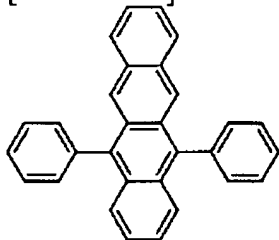
[0149] In example 16 example 15, the organic EL device was produced like the example 15 instead of the compound (A-1) except having used the compound (A-3). The engine performance of this thing is shown in the 1st table.

In example 17 example 15, the organic EL device was produced like the example 15 instead of the compound (A-1) except having used the compound (A-6). The engine performance of this thing is shown in the 1st table.

In example 18 example 15, the organic EL device was produced like the example 15 except having used the compound (A-7) and having used the coumarin 6 instead of Leblanc instead of the compound (A-1). The engine performance of this thing is shown in the 1st table.

It sets in the example of comparison 1 example 8, and is [0150] instead of a compound (A-1).

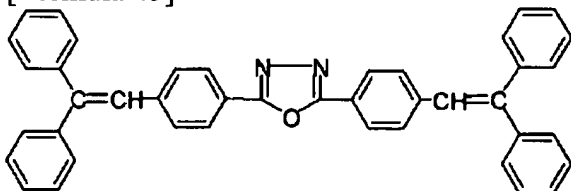
[Formula 44]



[0151] The organic EL device was produced like the example 8 except having come out and having used the compound of the structure shown. The engine performance of this thing is shown in the 1st table.

It sets in the example of comparison 2 example 15, and is the following oxy-diazo-RU compound [0152] instead of a compound (A-1).

[Formula 45]



[0153] The organic EL device was produced like the example 15 except *****. The engine performance of this thing is shown in the 1st table.

[0154]

[Table 1]

第1表

	電 圧 (V)	輝 度 (nit)	発光色	効 率 (lm/W)	輝度半減寿命 (hr)
実施例8	6.0	120	緑	4.2	1700
実施例9	6.0	210	黄	4.05	2000
実施例10	6.0	120	緑	2.4	1700
実施例11	6.0	210	青緑	1.86	1500
実施例12	7.0	420	緑	3.69	1200
実施例13	6.0	120	青	0.95	1500
実施例14	6.0	210	青緑	2.45	1700
実施例15	5.5	310	黄	3.89	1400
実施例16	5.5	280	黄橙	2.45	800
実施例17	5.5	210	黄	3.25	1700
実施例18	5.0	110	緑	5.2	2100
比較例1	6.0	210	緑	3.20	1100
比較例2	6.0	150	黄	2.10	120

[0155] [Note] The brightness reduction-by-half life performed the constant current drive of initial brightness 500nit to the bottom of a nitrogen air current, and asked for it by measuring time amount until brightness declines to 250nit(s). In the 1st table, when the organic compound of this invention is used as a recombination site morphogenetic substance so that examples 8-14 may be compared with the example 1 of a comparison and it may be known, more excellent effectiveness and a life are acquired. Moreover, when the organic compound of this invention is used as a luminescent material so that examples 15-18 may be compared with the example 2 of a comparison and it may be known, more excellent effectiveness and a life are acquired.

[0156]

[Effect of the Invention] The organic compound of this invention is useful as a component of an organic EL device, and when it uses as luminescent material or a recombination site morphogenetic substance especially, the outstanding effectiveness and the outstanding life are demonstrated.

[Translation done.]